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Memoranda of a revision of the North American Violets. II.[1]

ASA GRAY.

GROUP IV. Subcaulescent, first flowering from the ground, on slender mostly subterranean shoots from a deep thick rootstock or caudex, not stoloniferous nor creeping, later more caulescent, always low: corolla wholly or mainly yellow, except in last two species, the spur short-saccate: stigma beakless, sometimes with a short antrorse lip, concave, orbicular, antrorse-terminal or oblique at the large and gibbous-clavate summit of the style, bearded below its margin by a tuft or rarely a ring of stiff and reflexed or spreading bristles. Western species, but one cismontane.

* Leaves undivided, from roundish-ovate or cordate to lanceolate: lateral petals slightly bearded or beardless in the same species.

← Ovary and oval capsule glabrous.

V. pedunculata Torr. & Gray. California and Arizona.

V. Nuttallii Pursh. Kansas to the Saskatchawan, British Columbia, and the northern borders of California. Although some forms of this come near to the next, the capsule should distinguish them. A good part of Sir Wm. Hooker's *V. præmorsa* belongs here, namely the specimens of Scouler's collection. Also *V. linguæfolia* Nutt in Torr. & Gray.

← ← Ovary and globular capsule pubescent.

V. præmorsa Dougl. in Lindl. Bot. Reg. t. 1254; Hook. Fl. as to pl. Dougl. only. *V. præmorsa* and *V. Nuttallii* Benth. Pl. Hartw. 298. This proves to be the species more commonly known as *V. aurea* Kellogg, and a form of it must be his *V. Brooksii*. It ranges from W. Idaho and drier parts of Washington Territory to Southern and Lower California, in a great variety of forms, among them the var. *venosa* (*V. aurea*, var. *venosa* Watson, *V. purpurea* Kellogg): there are larger-leaved and long-petioled forms which approach *V. pedunculata*, and narrow-leaved ones which are very like *V. Nuttallii*.

* * Leaves finely dissected: subterranean shoots commonly sending up their scapiform peduncles from under ground; the last species more caulescent.

← Petals beardless, essentially yellow.

V. chrysantha Hook. Well marked by the bipinnately dissected leaves, beardless and deep orange-yellow petals, the upper slightly or largely brown-purple.

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[1] Concluded from page 256.

V. Sheltonii Torr. Known by the glabrous palmately dissected leaves of orbicular outline and light yellow petals. The stigma has the bearded tufts of the related species, but small.

+ + Lateral petals bearded; upper deep violet-purple or blue; lower pale or yellow.

V. Beckwithii Torr. & Gray, is pubescent or puberulent, its rounded leaves palmately about thrice 3-parted into linear or spatulate-linear acutish or obtuse lobes, the primary divisions petiolulate: upper petals deep violet-purple, the others light blue or bluish, with yellow base, lateral ones short-bearded.

V. Hallii Gray. Glabrous throughout: the leaves of ovate or oblong or irregular outline, subpinnately or pedately about twice parted into lanceolate or linear lobes, their tips obtuse or acutish and callous-apiculate, veins or ribs indistinct: upper stipules commonly foliaceous, often enlarged and laciniate or entire: upper petals deep blue, others yellow or cream-color.—From Salem, Oregon, to Humboldt county, California.

V. trinervata Howell, in printed distribution, and in BOTANICAL GAZETTE, viii. 207, as a questionable variety of *V. Beckwithii*. This is *V. chrysantha*, var. *glaberrima* Torr. in Wilkes Exped., xvii. 238, where it is said (doubtless from Pickering's notes) that the upper petals are purplish and the others yellow. It is well distinguished from *V. Hallii* by the more pedately and less dissected leaves; the divisions from lanceolate to almost ovate, acute or apiculate, at maturity almost coriaceous, and *prominently 3-ribbed*, the lateral ribs intramarginal; also by the small and entire and nearly free stipules. It is known only in the eastern parts of Washington Territory, was rediscovered by Howell in 1874, and later by Suksdorf.

GROUP V. Caulescent; the few-several-leaved stems erect from short or creeping rootstocks; no stolons; no radical flowers: spur of corolla short and saccate; lateral petals commonly scantily papillose-bearded: stigma beakless, bearded or pubescent at the sides.

* Petals yellow: main stems usually naked at base and few-leaved above.

V. lobata Benth. Pl. Hartw. A species of the Pacific Coast, with very various and mostly digitately cleft or lobed leaves: with

Var. **integrifolia** Watson, with mostly deltoid- or rhombic-ovate often caudate-acuminate leaves, which is to the species what *V. hastata* is to *V. tripartita* Ell. Perhaps it passes to *V. glabella*.

V. hastata Michx., an Alleghany Mountain species, extending to Ohio and to the northwestern borders of Florida; generally well marked by its approximate and deltoid-hastate or subcordate leaves.

Var. **tripartita**, the *V. tripartita* Ell., a remarkable form with trifid or 3-parted or even trifoliolate leaves, evidently, as LeConte maintained, only an usual state of *V. hastata*.

V. glabella Nutt. in Torr. & Gray, Fl. A Pacific species, ranging from the middle parts of California to Alaska and to Japan; its northernmost forms coming too near the Asiatic *V. uniflora* L., while its most eastern in the northern Rocky Mountains are not readily distinguished from *V. pubescens*. With Maximowicz, I conclude that we should keep up these species.

V. pubescens Ait. This common and rather variable Atlantic American species, contrary to Maximowicz, I must keep entire. The capsule in all its forms varies from oblong to globular (even on the same stems), and from glabrous to densely tomentose; and the very pubescent plants are connected by transitions with

Var. **scabriuscula** Torr. & Gray, which should have been named *glabriuscula*, for it really is not scabrous.

* * Petals white, with violet or purple tinge, and some yellow or yellowish at base within: stems more leafy or more prolonged by successive leaf- and flower-bearing growths up to midsummer: stipules small, narrow, entire and nearly scarious: capsule oval, glabrous.

V. Canadensis L. This ranges from Newfoundland to Saskatchawan and the Rocky Mountains, to those of Utah and Arizona. In New Mexico and Colorado it passes into

Var. **scopulorum**, a diminutive and depressed form, of which the most characteristic form was collected in Clear Creek cañon, by Mr. Greene.

V. ocellata Torr. & Gray. Known only in California; seems well to hold its characters as a species.

V. cuneata Watson, Proc. Am. Acad. xiv. 290, and Bot. Calif. ii. 433. Mountain woods in the northern part of California and adjacent Oregon. Distinguished from the preceding by its smoothness and its rhombic-ovate or cuneate leaves, only the radical ones cordate.

GROUP VI. Caulescent from more or less creeping rootstocks, or at first flowering nearly acaulescent, erect or spreading: leaves cordate, undivided: stipules more or less herbaceous: corolla from blue to white, with *projecting* oblong to cylindrical spur: style moderately thickened upward, beardless.

* Spur of corolla not very long: lateral petals usually bearded: stigma inflexed, a short scarious beak. (*Caninæ.*)

+ Stipules from serrate to fimbriate-pinnatifid or pectinate.

V. striata Ait. Stems 3-4-angled, ascending and at length a foot or more long, producing normal petaliferous flowers until midsummer or later: corolla yellowish-white; lower petal striate with brown-purple lines; spur thick, rather shorter than the sepals: capsule ovoid.—An Atlantic and mostly northern species, extending along the mountains to Georgia, and westward only to Minnesota and Missouri. My *V. laciniosa* of Japan is the analogue of this rather than of any form of the next, with which Maximowicz would associate it.

V. canina L. Our forms of this collective species, none of them quite identical with European, may be grouped under the following varieties:

Var. **Muhlenbergii**, the common Atlantic American Dog Violet, nearest to the Old World *V. canina*, var. *sylvestris*, may as well retain the name under which Torrey published it (as *V. Muhlenbergii*) in 1824, the same year in which it was named *Muhlenbergiana* in the Prodromus. The alpine and arctic form of it, *V. Muhlenbergii*, var. *minor* Hook. Fl., has recently been illustrated under this name by Lange in the Flora Danica, from Greenland. Dr. Engelmann detected a summer form of it on the sand-beaches of Lake Superior, answering to *V. arenaria*. Our plant is only spring-flowering; in summer it sends off prostrate stems bearing cleistogamous flowers.

Var. **multicaulis**, the *V. Muhlenbergii*, var. *multicaulis* Torr. & Gray, Fl., and doubtless *V. radicans* DC. (though the summer runners, so far as seen, do not root), is a peculiar form of the Southern Atlantic States, in rocky or sandy ground, from Kentucky to Florida and Texas; there flowering from February to April, depressed-spreading, and with round leaves; later in the season producing prostrate leafy branches or runners, bearing cleistogamous flowers.

Var. **adunca** Gray. To this, the type of which is *V. adunca* of Smith in Rees' Cyclopœdia, I refer all the far western forms of the species, which differ from the eastern somewhat in habit, in less cordate leaves, and in the generally longer spur which is disposed to be curved or hooked. The more southern and larger forms, which prevail in California, answer to *V. longipes* Nutt. The smaller and higher northern form answers to Regel's *V. canina*, var. *rupestris*.

Var. **oxyceras** Watson, in the Botany of California, is remarkable for its acute as well as long spur. It has been collected, so far as I know, only by Dr. Torrey near Donner's Pass over the Sierra Nevada, and by Brewer and later by myself on very high ground between Clark's and the Yosemite.

+ + Stipules entire, or nearly so, linear: flowers on scapes from the rootstock and few on 1-3-leaved ascending stems, pretty large.

V. mirabilis L. A species allied on one hand to *V. Langsdorfii*, on the other to *V. canina*, ranging from the mountains of Europe to N. E. Asia; and I somewhat doubtfully refer to it a plant collected in Oregon, near Portland, in coniferous woods, by Mr. Howell. The species was so named by Linnæus because the only one he knew having what are now called cleistogamous flowers.

* * Spur to corolla very long; petals beardless: style slender-fusiform, symmetrical; stigma erect and terminal, small: stipules laciniate-pectinate.

V. rostrata Muhl. A strongly marked species, of the Alleghany region, ranging from Upper Canada and Michigan, through the higher parts of the State of New York, to the mountains of Georgia. Mr. Dolph long ago sent me, from northern Pennsylvania, flowers having the spur 2-3-corniculate at tip.

The section *Melanium*, which includes the pansy and *V. cornuta*, now well known but not so common in our gardens, and which has the enlarged and globular apex of the style hollowed into a large and deep nectariferous and stigmatic cavity, is represented in America only by

V. tricolor L., var. **arvensis** DC. I had always taken this field form of the pansy for a mere escape from cultivation; but it occurs in rather numerous localities from Canada to Texas; and several botanists familiar with it insist that it is indigenous.

If we count this as indigenous, in deference to the weight of authority, we have thirty-three wild species of Violet in North America, all but eight of them endemic.

It is not out of place to remark that I persist in the opinion that *Solea concolor* of Gingius represents a genus quite distinct from *Ionidium*, and of course I should keep up *Hybanthus*.

The relative value of cultures in liquid and solid media in the diagnoses of bacteria.

THEOBALD SMITH.

The marked progress recently made in the study of micro-organisms as the cause of certain diseases is without doubt due to the more thorough application of various solid culture media by Koch and his pupils. Today the microscope does not hold the chief place in the study of these minute organisms. It is their mode of growth upon gelatine, blood serum, agar-agar, potato, in meat infusions, milk, etc., or the absence of growth on one or more of these substances and in these fluids which aids in confirming the microscopic examination. For this frequently yields results so indefinite that without the media mentioned it is impossible to come to any satisfactory conclusions as to the kind of bacteria under consideration. Besides these various tests, inoculation experiments are of essential importance in the investigation of pathogenic forms.

In connection with the cultivation of bacteria for diagnostic purposes, it is again desirable to call attention to liquid media and their uses. The statements of Koch and others several years ago concerning the unreliability of liquids have almost driven them from the field in Germany and in our own country.

Pasteur, the founder of this new and brilliant branch of pathology, made cultures in meat broths or decoctions exclusively. That grave errors may arise in this way through contaminations which can not be easily detected is self-evident. When gelatine and other solid media were introduced by Koch he discarded cultures in liquids except for very special purposes. Since that time they have been looked upon with distrust, and results obtained with their aid suspected and questioned.

If there were some means of keeping liquids free from contamination, it is not unfair to say that they would be better adapted as a natural medium of bacterial life than any solid media ever suggested. This is self-evident for germs endowed with motility. One of the advantages of solid media is derived from the fact that any after-contaminations are quite easily detected with the unaided eye. This is not so readily done in the case of liquids. There are two ways of overcoming this difficulty: (1) by the use of a culture tube in which the parts are so adjusted that a momentary exposure for purposes of inoculation, etc., is practically without any danger whatever; (2) by frequently testing liquid cultures

on solid media, preferably on gelatine. My experience with the culture tube devised by Dr. D. E. Salmon has been entirely satisfactory. Its efficiency may be considered quite perfect. As it has been fully described[1] I need not dwell upon it here. The testing of liquid cultures is very simple and quickly accomplished. Either a minute portion is shaken up with liquified gelatine and the mixture poured on glass plates, or a platinum wire frequently dipped into the culture liquid is drawn several times across a layer of gelatine not yet congealed. In either case the developing colonies will determine the purity or impurity of the liquid culture. I have almost invariably found the thirteenth or fourteenth generation as pure as the first, and I should be surprised to find one out of every hundred impure.

I will grant unreservedly that test tubes plugged with cotton wool are not fit for liquid cultures. For gelatine in such tubes, when frequently exposed, is invariably invaded after a time by fungi or bacteria. The plug being a nidus for dust, its removal is always attended with danger. Because a culture tube which eliminates the use of a large removable plug is more costly, it does not follow that it should not be used in scientific research. We know that in the department of physics, chemistry and physiology, the most advanced work is of necessity performed with the most complex apparatus. That there are those who do not succeed in keeping liquid cultures pure, does not concern those who do. It behooves the former, in the interests of a true scientific spirit, to improve their apparatus and techinque instead of condemning the method.

Conceding then for the present that cultivations in liquids can be kept free from contamination, the point at issue is the employment of liquids for diagnostic purposes. Whoever has paid any attention to the multiplication of bacteria in nutritive fluids, has no doubt been surprised at the variety of features which present themselves, and at the regularity with which the same ones appear in cultures of the same microbe. To illustrate how many different characters may be used in determining the kind of bacteria and the purity of the cultivation, I will briefly outline a few of the more important ones as they have come under my own observation, referring the reader to Miquel[2] for characters of bacteria obtained from the air, soil and water.

Every cultivation made in a tube shaped like a test-tube presents three regions for observation—the liquid itself, its surface,

[1] First Annual Rep. Bureau of Animal Industry, Dept. Agriculture, 1884, p. 229; American Monthly Microscopical Journal, 1884, p. 185.

[2] Annuaire de l'Observatoire de Montsouris pour l'an 1885, p. 577.

and the bottom of the tube. In other words, there may be a membrane covering the liquid and a deposit in the bottom. With reference to the liquid itself, it may remain clear or become clouded. In the former case the growth may appear as a membrane or a deposit, or it may be disseminated through the fluid in minute granules, flakes or cloud-like masses. The cloudiness may be very faint—a slight opalescence—or it may be dense, approaching a turbidity. When shaken the cloudiness may be, as it were, set in motion, and thus show itself composed of elements, indistinguishably minute, or as granular or flocculent masses; or it may be impossible by shaking to disturb the uniform opalescence. The liquid may become colored. There may or may not be a membrane present. It may vary from a mere iridescent pellicle to a thick creamy layer. Its formation and growth should be carefully noted, together with its color, consistency and structure when fully formed. The deposit may be absent, very scanty, or quite abundant and colored. When agitated it will rise from the bottom in coarse or fine flakes, as a viscid ropy mass, or as a fine powder. In connection with these characters it is necessary to take into consideration the composition and reaction of the culture liquid. The temperature to which the culture is exposed has a marked effect upon the rapidity with which these characters appear. The odor and reaction of the culture of a certain age are also valuable in many cases.

When these various features, and many others not given above, are taken alone and in combination, we have for most cultures an almost positive means of diagnosis as well as a ready method of detecting contaminations, for these features are as a rule constant. In order to illustrate this statement I will write down a few features of the growth of *Bacillus subtilis*[3] in a neutralized infusion of beef to which 1 % peptone has been added. In a temperature of about 35° C. the liquid becomes opalescent in from 6 to 8 hours. When agitated, rolling cloud-like masses are outlined by a condensation of the suspended bacteria. Within 24 hours an interlacing network, or islands of a whitish gelatinous deposit appear on the surface, which within another day are fused into a white papery membrane covering the entire surface. This membrane, which is not smooth, but puckered and pouched in a peculiar way, pushes its border up the sides of the tube, resembling at this stage the cup of an acorn. The liquid itself gradually clears up in the mean time until it is quite as limpid as before inoculation. This clearing up of the liquid, together with the pe-

[3] This bacillus can be obtained pure at any time by boiling in a water bath, for from ½ to ¾ hour, a filtered infusion of hay contained in a flask plugged with cotton wool.

culiar cup-shaped membrane, is very characteristic of this bacillus, certainly as reassuring to the observer as the stellate growth of its colonies on gelatine. For if another microbe be present, the liquid remains clouded and the membrane is modified. There are many other points of interest in connection with the membrane and the deposit formed later, which I forbear to mention here, as their value for diagnostic purposes is limited by their tardy appearance.

If we now turn our attention to solid media, we shall find that diagnosis often fails when the bacteria do not liquefy the substratum. The colonies then are apt to develop very much alike, and any modification may as well be credited to changes in the consistency of the gelatine, due to variations in temperature, to drying, etc. These same changes will modify the appearances of colonies of the same microbe. Tube cultures in gelatine of radically different bacteria are frequently almost identical in appearance, or else the slight differences are found not constant. In such cases cultures in fluids are frequently of great service. In a recent paper[4] before the American Association for the Advancement of Science, I called attention to two pathogenic forms identical microscopically and in their effects upon animals though found in widely separate sections of our country. One of the few differential characters was the presence of a membrane in the liquid cultures of one germ, its absence in the other.

The great importance of solid media in isolating bacteria and testing the purity of cultures is conceded by all engaged in this field of research. The advantage of starting cultures from a single germ by inoculating them from the colony, its progeny, is inestimable in obtaining accurate and reliable results. But that liquids have also a place, and a very important one, the facts above stated will, I hope, demonstrate without a doubt.

Botanical characters of the Black Rot, Physalospora Bidwellii Sacc.*

F. LAMSON SCRIBNER.

(WITH PLATE IX.)

The external characters of black rot of the grape are determined by the growth of the mycelium of *Phoma uvicola* B. & C., or, if we assume the mature form to be correctly determined, *Physalo-*

[4] Medical News, 1886, Oct. 18.

* Read before Botanical Club, A. A. A. S., Buffalo meeting, 1886.

spora Bidwellii Sacc. As soon as the berry exhibits any signs of the malady, a thin section through the discolored part will show, under the microscope, the mycelium or vegetative portion of the fungus. This will be found near the surface of the berry and will be seen to consist of hyaline, colorless threads or hyphæ, of very irregular diameter (1–4μ), much branched and provided with more or less frequent septa. The very young branches remind one by their shape of the haustoria of *Peronospora*, but their position in respect to the cells of the host and their subsequent development reveal their true character. The presence of the septa is alone sufficient to distinguish the mycelium of the *Phoma* or *Physalospora* from that of *Peronospora*.

The mycelium traverses the tissues both between and through the cells and under its action the latter soon lose their turgescence and their contents turn brown; they gradually collapse and flatten, and the dried pulp remains only as a thin layer of tissue in which the vegetative part of the fungus occupies a large part.[1] During the earlier stages of the disease the mycelium is most abundant near the surface of the berry and here, at frequent points, just beneath the cuticle, it makes a condensed growth that results in the formation of the perithecia or conceptacles destined to contain the spores. At first colorless, the pseudo-parenchymatous tissue of these conceptacles soon become pale yellow, then brown and finally black. The conceptacles themselves are ovoid or globular bodies varying in size from 75μ to 140μ in diameter, and in their development they raise and finally burst through the cuticle, imparting to the surface of the berry a pimply or punctulous appearance. At the apex of the exposed part of each conceptacle there is a minute opening, or osteolum, through which the spores escape at maturity.

The microscope reveals the fact that the conceptacles are of two sorts—*pycnidia* and *spermagonia*—names determined by the character of their contents, otherwise they do not differ except in size, the pycnidia being the larger.

Pycnidia.—A cross-section of a pycnidium shows first a clear zone lining the cavity, consisting of very delicate tissue that gives rise to the short and thin walled threads, the *basidia*, upon which are borne the spores, in this case called *stylospores*, that completely fill the remaining portion of the cavity. These stylospores are one-celled, round or somewhat oblong, being in their longest diameter about 8μ. Under an amplification of 500 diameters the cell wall is clearly discernible, the contents having

[1] Viala and Ravaz, "Memoire sur une nouvelle maladie de la vigne, Le Black Rot," p 416.

a beaded appearance, or sometimes one or two nuclei in the othwise clear contents are seen. These spores escape, probably by the absorption of water through the osteolum or opening at the apex of the pycnidium. Under certain conditions they issue as a minute worm-like thread, which is composed of vast numbers of spores glued or held together by a kind of mucilage. These threads which are more or less twisted are easily seen with a pocket lens. This manner of protusion is probably not constant, but exists under certain favoring conditions.

The stylospores germinate freely in water within a space of three or four hours. They throw out a slender tube which soon provides itself with septa, branches and quickly developes into a mycelium in every way like that seen within the tissues of the berry. How long these stylospores may retain their germinative power is unknown, but it is not likely that they hold it through the winter season.

SPERMAGONIA.—The spermagonia have exactly the appearance of the pycnidia but are usually smaller, they are also far less numerous. Within the outer wall there is a clear zone from which arise the very slender basidia that project radially toward the center of the cavity. The spores, or as they are termed, the spermatia, having been supposed to have a fertilizing power, are borne upon the summit of the basidia and when mature escape in vast number from the spermagonium through an opening at its apex. They are cylindrical, obtuse at each end, 5-8μ long and about 7μ in diameter. What may be the rôle of these spermatia in the economy of the fungus is a matter of speculation. In speaking of the nature of these bodies in general, in the order Pyrenomycetes, Cornu says they are true spores, since they germinate and give out filaments having all the appearance of mycelial threads. He regards them as very small conidia of a special form, borne upon particular arbuscles in protecting conceptacles. They do not in general germinate in pure water and they have a rather slow development; their physiological rôle appears to be determined by their very small size and the circumstances which their germination require.

It has been quite generally supposed that they constitute the male element in the process of reproduction, but there is no evidence to sustain this opinion. Their very small size and consequent lightness have suggested to the minds of some that their office is to more certainly effect the wide distribution of the fungus. It seems to have been conclusively shown that they are not the spores of a parasite on the Phoma.

The species of the genus Phoma are believed to represent

merely one stage or condition of certain ascigerous or ascosporous fungi, yet to be determined. Professor W. G. Farlow has very carefully described and illustrated the various conditions or spore-bearing forms of the fungus that causes the Black Rot of the plum and cherry trees, *Sphæria morbosa*. In this case there are shown pycnidia containing stylospores and spermagonia filled with spermatia, *conidia* produced externally on short stalks or *conidiophores*, and *sporidia*, which are spores formed in little sacs or asci within a perithecium. The last or ascigerous form is the mature or perfect state of the fungus. We have here four distinct varieties of supposed reproductive bodies, pycnidia, spermagonia, conidia and sporidia. In the black rot we have seen the first two upon the same mycelium and even associated in the same *stroma*, so that there is no possible doubt of their connection, and, reasoning from analogy, we would expect to find also the conidial and ascigerous forms.

Conidia.—I am confident that I have seen upon completely diseased berries gathered from the vine, but more particularly upon similarly diseased berries kept moist for a few days under a bell jar, the conidiophores of the Physalospora bearing imperfectly developed conidia. They certainly appeared to be growing from the exposed portion of the pycnidia, but whether from these or from specially formed sclerotia I am not prepared to say.

Messrs. Viala and Ravaz state that berries diseased with black rot, placed in the earth, have developed sclerotia; and, maintained in the soil at a temperature of 18° to 20° C., these sclerotia have produced conidioferous filaments. At Val Marie, upon the 17th of December, they observed sclerotia upon berries that had lain upon the ground for some time after being destroyed by this disease. These berries, placed in a moist atmosphere at a temperature of 20° to 22° C., produced the same conidioferous filaments.

The conidia serve to propagate the fungus, and consequently the rot which it occasions. If their development be delayed until spring, as perhaps it often is, a knowledge of their existence is particularly important, for by them the disease may be perpetuated from year to year.

Sporidia.—The discovery of the mature or ascigerous form of the so-called *Phoma uvicola*, or what it seems reasonable to assume to be such, is recorded by Mr. J. B. Ellis, of Newfield, New Jersey, in the Bulletin of the Torrey Botanical Club for August, 1880 (vol. vii, page 90). Mr. Ellis says that in the early part of May, 1880, Dr. E. C. Bidwell, of Vineland, New Jersey, informed him of having made this discovery on grapes which had

been diseased with the rot the season previous and were still hanging dry and shriveled on the vines. By way of experiment some of these berries were placed in water, where they were allowed to soak for three or four days. At the expiration of this time many of the perithecia (that before only contained Phoma spores) were now filled with well developed asci containing immature sporidia. Following up this discovery, Mr. Ellis at once searched for similar developments in shriveled grapes from his own vicinity. His efforts were rewarded by finding some ascigerous perithecia, together with an abundance of Phoma, on grapes gathered from the ground where they had probably lain through the winter.

Messrs. Viala and Ravaz did not succeed in finding, nor were they able to induce the development of the ascosporous form, neither have my efforts to this end met with better success. Thanks to the kindness of Mr. Ellis, who has very generously supplied me with specimens, I have been enabled to study its appearance and illustrate it.

The perithecia containing the asci are in all respects like those that enclose the stylospores, and they have every appearance of being developed from the same mycelium. The walls of the asci are very transparent, and it is difficult to determine their outline except they be separated and examined singly. They are cylindrical or subclavate, abruptly contracted at the base, obtuse at the summit, straight, or occasionally somewhat curved. Except for the sporidia they are perfectly transparent. Each ascus contains eight sporidia.

Mr. Ellis named this fungus Spheria Bidwellii, in honor of its discoverer; by a more recent classification it becomes *Physalospora Bidwellii* Sacc.[2] If we are right in our conclusions, we see that this parasite has four kinds of reproductive bodies: first, the stylospores, enclosed in conceptacles, together constituting the *Phoma uvicola* of authors; second, the spermatia produced at the same time and enclosed in similar though smaller conceptacles; third, the conidia externally developed on short conidiophores; and fourth, the sporidia which are formed in asci that are enclosed in a protecting perithecium. The stylospores (and possibly also the spermatia) are undoubtedly designed for the immediate propagation of the fungus. The conidia probably serve the same purpose, and by their tardy development may help to continue the fungus from year to year. The sporidia are without doubt the special reproductive bodies for the latter purpose. The mycelium

[2] The description given by Ellis is as follows: "Peritheciis minutis globosis epidermidi tectis demum suberumpentibus, apice poro pertusis; ascis clavate-cylindraceis obtusis .0027 X.0005', sporidiis octo, irregulariter ellipticas vel oblongas (continuas?), .0005-.0007' X.00015-.0002' foventibus; paraphysibus nullis."

within the diseased berries retains its vitality during the winter months and through the agencies of warmth and moisture of early spring and summer the asci and sporidia are produced.

The germination of these sporidia has never been observed, but if by any system of culture they can be made to reproduce the Phoma of the Black Rot their real nature will be settled beyond dispute.

EXPLANATION OF PLATE IX. Fig. 1. A fragment of epidermis of a diseased berry, showing five of the black "pustules" formed by the development of the pycnidia. From four of these slender, contorted, worm-like filaments are being extruded; these are the stylospores held together by a kind of mucilage.

Fig. 2. A section through a bit of the berry, including a pycnidium (P) and a spermagonium (S). At O is the osteolum of the pycnidium through which the spores escape at maturity.

Fig. 3. A section of a portion of a pycnidium, more highly magnified, showing the basidia.

Fig. 4. Three stylospores germinating.

Fig. 5. A section through the perithecium or conceptacle of the ascosporous form, showing the asci, etc.

Fig. 6. Two separate asci, showing the 8 sporidia in each.

Fig. 7. Four of the sporidia that have escaped from an ascus.

Fig. 8. An ascus, enclosing 8 sporidia, found June 2, 1886, in grape (destroyed in 1885 by "Black Rot") kept for a week in moist air. From camera lucida sketch made by Erwin F. Smith in the laboratory of the University of Michigan. Mr. Smith notes that the "receptacles containing the asci are numerous, and the asci themselves abundant."

Synopsis of North American Pines, based upon leaf-anatomy. II.*

JOHN M. COULTER AND J. N. ROSE.

8. **P. monophylla** Torr. & Frem. Section almost circular: stomata in 18–26 rows: number of ducts two[4] (.055–.115 mm.): number of cells in bundle-sheath 30–55: strengthening cells in fibro-vascular region: leaf 1 to 2 in. long.

In the Sierra Nevada and mountains of California.

The single leaf serves well to distinguish this species. It has been considered a single leaf or a connate pair, but its minute structure at once decides that it represents but one of the two leaves found in P. edulis, and the notion

*Continued from page 262.

[4] Dr. Engelmann, in *Bot. Calif.* ii. 124, says that the ducts vary from 2 to 14, but we have found but two. Our specimens have included the type.

that the two leaves of the latter are the representatives of the one in P. monophylla can not be held for a moment. If, therefore, P. monophylla and P. edulis intergrade it can only be on the supposition that an entirely new leaf is formed. Dr. J. S. Newberry[5] states that he has observed the two species running together, and that in certain intermediate regions he has seen trees upon which both single and double leaves were found. This would surely indicate a very close relationship, borne out by their minute structure, but in the absence of specimens from these intermediate forms we would suspend judgment. Dr. Hooker[6] still claims, from his own observations, that they are distinct. If Dr. Newberry's testimony is confirmed by a study of the minute structure of these intermediate forms the question would seem to be settled.

9. **P. edulis** Engelm. Closely resembling the last, but the much smaller section semicircular (2-leaved) or rarely triangular (3-leaved): stomata in 5–15 rows: ducts .030–.060 mm.: number of cells in bundle-sheath 15–40: leaves somewhat shorter.

S. Colorado, New Mexico, and W. Texas.

The 3-leaved forms of P. edulis we have received raise the question whether they should not rather be referred to the next species, not so much on account of the 3-leaved character, but because it is accompanied by the absence of dorsal stomata.

+– +– No stomata on dorsal side of leaf.

++ Dorsal side of leaf much broader than either ventral: cuticle not specially thickened: stomata not deeply set, the subsidiary cells even forming slight protuberances.

10. **P. cembroides** Zucc. No ventral furrows: stomata in 4–6 rows: dorsal ducts two, nearer the edge than the middle (.025–.040 mm.), completely surrounded by strengthening cells, which are also in fibro-vascular region: leaves (3) slender, 1–2 in. long.

Throughout the southwestern mountains and Mexico.

Occasional specimens of this species show stomata on dorsal side of leaf and hence a close relationship to the preceding group.

11. **P. latisquama** Engelm. Like the last, but with a broad furrow on each ventral face: ducts smaller (.020–.030 mm.), not always completely surrounded by strengthening cells: leaves more slender and longer.

Mexico.

12. **P. Parryana** Engelm. Resembling P. cembroides, but with section much (often twice) larger: stomata in 8–10 rows:

[5] *Bulletin Torrey Bot. Club*, xii. 50; xiii. 183.

[6] *Gardener's Chronicle*, July 31, 1886.

ducts much larger (.050–.090 mm.): leaves (mostly 4) shorter and much thicker.

S. California and southward into Lower California.

In reference to this whole group of "nut pines" (the last five species) Dr. Engelmann[7] says "it is an open question whether these species may not properly be united into one, as the difference of flowers and fruit is very slight, and that of foliage is only relative." We have been able to separate them upon the characters given, but do not claim that they should be kept specifically distinct. It is evident that they are very closely related, and if the differences noted do not serve to make them specifically distinct they will all have to be included under one species. For the present it seems better to keep them separate.

++ ++ Dorsal side of leaf about as broad or narrower than either ventral: cuticle often much thickened, and stomata very deeply set: leaves in fives.

13. **P. Balfouriana** Murray. Strengthening cells about two layers, sometimes three in the angles, very few in fibro-vascular region: ducts dorsal, two (.040–.080 mm.), always completely surrounded by strengthening cells, position as in P. cembroides, or nearer the middle, sometimes parenchymatous: leaves 1–1½ in. long.

Mountains of California.

14. **P. aristata** Engelm. Resembling the last, but strengthening cells fewer, but one layer next the epidermis, sometimes two on the dorsal side or at the angles, and an incomplete sheath or none at all about the ducts: dorsal ducts one or two, smaller (.025–.050 mm.), near the middle of the dorsal face, often quite close together: leaves as in the last.

Mountains of Colorado, Arizona and westward.

In *Bot. Wheeler's Report*, p. 375, Dr. Engelmann reduces this species to a variety of P. Balfouriana. Judging from its leaf structure it should be restored to specific rank, for it is more distinct than many that are kept separate, and its superficial characters confirm this claim.

ǂ 2. Fibro-vascular bundles two: ducts mostly parenchymatous or internal.

* Ducts parenchymatous (mostly peripheral in P. resinosa).

+– Bundle-sheath thick-walled (except sometimes in P. Sabiniana)

++ A thin-walled layer next the epidermis.

= Leaves in pairs.

[7] Trans. St. Louis Acad. IV. 178.

a. Strengthening cells about ducts, but none in the cortical region. Atlantic species.

15. **P. resinosa** Ait. Thin-walled cells small, tangentially oblong, not half as large as the epidermal cells: leaves 5-6 in. long.

Massachusetts to Minnesota.

The ducts are mostly peripheral, as in the first section, though parenchymatous ones are quite common. This species seems to form a sort of transition between the two sections, which are apparently quite widely separated here owing to the absence of about a dozen Old World species.

b. Strengthening cells in the cortical region, but none about ducts: Pacific coast species.

16. **P. contorta** Dougl. Thin-walled cells as in P. resinosa, and about half as large as the strengthening cells, which mostly form but one continuous row interrupted only by stomata: ducts one or two, often wanting, larger than in the next species (.050-.090mm.): leaves 1-1½ in. long.

All along the Pacific coast.

When old the leaf structure resembles that of P. Banksiana and P. inops.

17. **P. muricata** Don. Thin-walled cells larger than in the preceding, only a little smaller than the epidermal and larger than the strengthening cells: ducts 2-9, very small (.025-.040 mm.): leaves 4-6 in. long.

Along the coast of California.

This species has been confounded with forms of P. contorta, but they are well distinguished by the characters given above.

= = Leaves in threes (sometimes fours or fives): ducts 2-10.

18. **P. Engelmanni** Carr. Strengthening cells abundant in cortical region, extending half way to the ducts; rarely any about the ducts; abundant in fibro-vascular region: ducts 8-10, very small (.020-.030 mm.): leaves 13-15 in. long.

Mountains of Mexico.

Our description of this little known species is taken from specimens obtained from the Harvard herbarium. Dr. Engelmann describes the single specimen obtained by Wislizenus, in 1846, as having "strongly developed strengthening cells around the ducts," a character which our specimens do not show. The strengthening cells are unusually developed and are often larger than the epidermal cells. Parlatore considered this species a form of P. Montezumæ, but its leaf structure is very distinct from what is found even in that polymorphous species.

19. **P. Coulteri** Don. Strengthening cells larger than the epidermal cells, in the cortical region broken into heavy bundles by the frequent rows of stomata; sometimes about the ducts; very numerous in fibro-vascular region on both sides: ducts 4-10, quite variable in size (.025-.100 mm.), sometimes internal: leaves 6-12 in. long.

Along the Pacific coast.

20. **P. ponderosa** Dougl. Strengthening cells smaller than epidermal cells, in 1 to 3 rather regular rows in the cortical region; also about the ducts: ducts mostly two, often five or more, quite variable in size (.030-.070 mm.): leaves 5-11 in. long.

Generally distributed throughout the Rocky Mountains and westward.

31. **P. tuberculata** Gordon, may be looked for in this group.

= = = Leaves in fives: ducts always 3, one in each angle.

21. **P. Arizonica** Engelm. of S. Arizona, and

22. **P. Montezumæ** Lamb. of Mexico, can not be separated by leaf characters. The latter species has a wide range of forms, and is but poorly circumscribed. It is quite possible that further knowledge of external characters may require these two species to be reduced to one. All the forms have well developed strengthening cells.

++ ++ No thin-walled layer next the epidermis: strengthening cells about ducts and in fibro-vascular region.

= Leaves in fives: stomata deeply set.

19. **P. Coulteri** Don. may be looked for in this group.

23. **P. Torreyana** Parry. Outline of section mostly triangular: stomata numerous, 8–13 rows on each face: 3–5 rows of strengthening cells in cortical region: ducts mostly 3 (.040–.060 mm.), sometimes with accessory internal ones: leaves 8–11 in. long.

Coast of Southern California.

= = Leaves in threes: stomata not deeply set.

24. **P. Jeffreyi** Murray. Strengthening cells in 2 or 3 rows in cortical region; one complete row about ducts: ducts two or more (.040–.060 mm.): leaves 4–9 in. long.

Eastern slope of the Sierras and ranging into Oregon.

The leaf structure is much like that of P. ponderosa, to which species it is often referred as a variety, but is very distinct in the absence of the sub-epidermal thin-walled layer.

25. **P. Sabiniana** Dougl. Strengthening cells in bundles in cortical region, and usually about ducts; which are mostly two (.020–.050 mm.): the cells of the bundle-sheath are often thin-walled, and the species may be looked for under the next group: leaves 8–12 in. long; the section considerably smaller than in P. Coulteri, with which it may be confused.

Mountains of California.

+– +– Bundle-sheath thin-walled: a thin-walled layer next the epidermis.

++ Strengthening cells in fibro-vascular region; few, if any, about ducts.

= Leaves in threes.

26. **P. Tæda** L. Strengthening cells in the angles much larger than epidermal cells, in the rest of the cortical region only about half as large; also on dorsal side in fibro-vascular region: ducts quite large for the section (.037–.075 mm): leaves 5–6 in long.

Delaware to Florida and westward to Arkansas.

27. **P. serotina** Michx. Strengthening cells equalling the epidermal cells, or smaller, numerous in the angles, elsewhere in the cortical region in bundles or single layers; generally absent from the ducts; in the fibro-vascular region on either or both sides of the fibro-vascular bundles: cells of the thin-walled layer quite small: ducts mostly 5–7, often half of them internal (.025–.050 mm.): leaves 6–8 in. long.

From N. Carolina to Florida.

28. **P. rigida** Miller. Like the last, but strengthening cells not so numerous in the cortical region, in two or three rows, about the size of the epidermal cells, or larger in the angles: ducts 3–7: leaves 3–5 in. long.

From New Brunswick to Kentucky.

29. **P. insignis** Dougl. Epidermal cells forming an arch next the stomata, making an oval cavity which opens below: strengthening cells (as well as thin-walled layer) mostly larger than epidermal cells, in one or two rows in the cortical region; sometimes found in the fibro-vascular region: leaves 4–6 in. long.

Coast of California.

19. **P. Coulteri** Don., and
31. **P. tuberculata** Gordon, may be looked for in this group.

= = Leaves in pairs.

30. **P. pungens** Michx. Thin-walled cells quite small:

strengthening cells in small bundles separated by the rows of stomata, much more numerous and larger in the angles; generally present in the fibro-vascular region: leaves 1–2½ in. long.

In the mountains from Pennsylvania to Tennessee.

++ ++ No strengthening cells in fibro-vascular region, nor about the ducts.

= Leaves in threes.

31. **P. tuberculata** Gordon. Thin-walled cells smaller than epidermal: strengthening cells in one or two rows, larger than the epidermal cells; rarely some about ducts and on dorsal side of fibro-vascular region: ducts 2 to 5, small (.020–.030 mm.), often with several internal.

Throughout the western mountain systems.

23. **P. Tæda** L., and
26. **P. insignis** Dougl. may be looked for here.

= = Leaves in pairs.

32. **P. inops** Ait. Epidermal and strengthening cells about the same size and quite small, the latter in a single layer: lines of stomata quite numerous: ducts occasionally internal: fibro-vascular bundles often widely separated: leaves 1½-3 in. long.

Along the coast from New York to S. Carolina, westward through Kentucky to Indiana.

33. **P. clausa** Vasey. Lines of stomata 10-20: strengthening cells often entirely wanting, or with a few scattered peripheral ones: ducts mostly two, one of which is occasionally internal, varying but little in size (.030-.035 mm): leaves but half as wide (1 mm.) and longer than the last.

Florida.

34. **P. mitis** Michx. But one layer of strengthening cells, which are little smaller than the epidermal: ducts small (.020-.030 mm.), often as many as six: leaves 3-5 in. long, not twice as wide as thick.

New York to Florida, westward to Texas and Kansas.

35. **P. glabra** Walt. Ducts rather large (.050-.060 mm.) for the group, fewer than in the last, mostly 2 or 3, sometimes with one of them internal: leaves 3-4 in. long, twice as wide as thick.

South Carolina to Florida and through the Gulf States to Louisiana.

36. **P. Banksiana** Lamb. Cells of thin-walled layer smaller

than strengthening cells: ducts (.030-.060 mm.) sometimes wanting: leaves 1 in. long.

In the northern States.

30. **P. pungens** Michx. may be looked for here.

* * Ducts always internal: bundle-sheath thin-walled.

37. **P. palustris** Miller. Cells of thin-walled layer generally much smaller than those of the epidermis: strengthening cells mostly on ventral side of fibro-vascular region: ducts variable in size (.040-.050 mm.), with few strengthening cells: leaves 10-15 in. long.

P. australis Mx.

Virginia to Texas.

38. **P. Cubensis** Griseb. Cells of thin-walled layer large, often equalling those of the epidermis: strengthening cells about as large as epidermal, mostly but one layer; sometimes more in the angles, and even extending to the ducts; none about the ducts nor in fibro-vascular region: ducts variable in size (.050-.080 mm.), often with accessory parenchymatous ones: fibro-vascular bundles but little separated, often blended: leaves 7-12 in. long.

P. Elliottii Engelm.

South Carolina and Florida.

NOTE.—We would be pleased to receive from our friends specimens for identification, as doubtless a wider range of forms will lead to some modifications.

BRIEFER ARTICLES.

A case of teratology.—It is not always that the continuity of the leaf-spiral can be readily demonstrated with opposite or whorled leaves. Teratology sometimes helps us out. A stem of the garden valerian, Valeriana officinalis, was lately found which had grown to several times the usual diameter and become much shortened and spirally twisted. Where the tissues of the stem were nearly horizontal the leaf-spiral was nearly vertical and the leaves were inserted vertically with their buds at the side. The twisting, as is common with monstrous formations of the stem, was confined to the single axis.

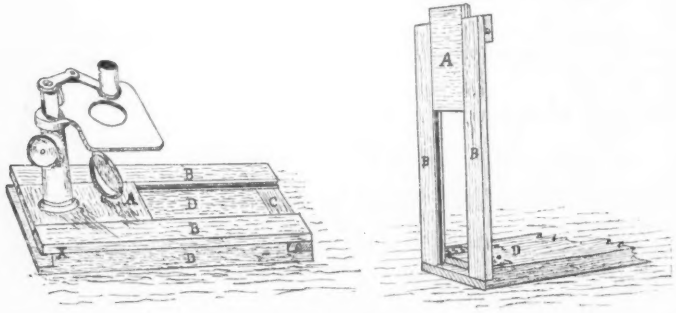
A. A. CROZIER.

Puccinia Malvacearum Mont. in Massachusetts.—I have recently received some leaves of hollyhock from the garden of Prof. C. L. Jackson, at Beverly, Mass., which were attacked by the true Puccinia Malvacearum common in many parts of Europe. In all respects the leaves attacked resemble

those which I have examined from Europe, and differ from those which I found in California, of which a notice was published in the BOTANICAL GAZETTE of September, 1885, in having isolated, light yellow sori instead of the aggregated, or somewhat concentric, and dark brown, almost black sori found in the affected hollyhocks of Santa Barbara. The fungus from Beverly is of interest not only because very little is known of the occurrence of P. Malvacearum in the Eastern States, but also because in this case we have an accurate record of the advent of the fungus. The disease was unknown at Beverly until the present year, and was imported with some seeds of Malope from Europe last season. At present the disease is confined to the Malope and hollyhocks of Prof. Jackson's garden and that of one of his neighbors, other gardens being free from the disease.

W. G. FARLOW.

Making drawings with a dissecting microscope.—The apparatus consists of a Zentmayer's dissecting microscope, the Rothrock model, the round metal base being replaced by a wooden one, which is made as follows: A heavy board (D in figure) 6×12 inches, having a shoulder cut at each end, forms the ground work; to this are hinged on either side at X, the two strips B B, each 1½×12 in. and grooved on their inner edges; these are bound together by the strip C; between the strips B B is placed the piece marked A, which is tongued to fit the groves. Two holes are made in A, one to receive the screw at the base of the microscope, the other for the attachment of the mirror. When the object is prepared for drawing, A is carried forward to C, and then raised with B B into a position at right angles with D, the weight of the microscope and the shoulder at the end of D keep this portion in position.



A Wollaston's camera lucida is now placed over or rather back of the lens and the object drawn in the usual way.

The lenses used are a one inch and a one-half inch achromatic triplets having special adapters for fitting into the arms of the microscope stand and for receiving the camera lucida. Mr. Zentmayer has made these fittings or adapters under my direction, and modified the mounting of the camera slightly, making it more convenient for use than in its usual form.

The piece A can be raised or lowered and fixed at any point so that various degrees of enlargement in the drawing are secured. Upon the stage I have a piece of plate glass $1\frac{1}{2} \times 3$ in. upon which my dissections are usually made. A space in the center of this glass slip is ruled to millimeters, twenty-five millimeters each way. This ruling, as made for me by J. W. Queen & Co., does not interfere at all with the work of dissecting, while it enables one to measure in the easiest possible way any object on the plate, and in making the drawings the scale of enlargement is always before you and can be noted in a moment. The slip of glass is held to the stage by spring clips which are attached to the stage but are not shown in the figure.

In making drawings for photo-engraving it is essential that the lines be black. For this purpose Higgins' American drawing ink is very good. An excellent pen for very fine work is No. 1459 of Keuffel & Esser.

F. LAMSON SCRIBNER.

Plan for laboratory work in Chemical Botany.*—Chemistry furnishes the means for investigating plants. The chemical study of a plant includes not only macro- and micro-chemical work, but also gross and minute anatomy study Two years ago when I saw Prof. Goodale repeat Pfeffer's experiment of putting together certain constituents and building up a cell, I also saw that cell form was not fundamental, but that construction lay back of form and determined it Form is a property of a substance, so to speak. If this is so, even the study of anatomy falls under chemistry and it determines how a plant shall be investigated.

Organic chemistry has two departments. As a special and not an inclusive subject, it investigates elements and compounds in themselves and in their relation to each other apart from their place of occurence. When a study is made of the combination and relation of these substances under what is generally termed life, botany has been entered upon. That is to say, that department of organic chemistry termed the proximate analysis of plants is divisible. One of its subdivisions really belongs to botany and should be relegated to it.

Whatever may be true in other countries, the chemical plant study now being done in America is not alone imperfect in results but *methods*. The chemist extracts the various compounds from the plants and examines them without regard to their relation to the plant. The botanist does little better. With the highest power of his microscope, he entirely misses many of the constituents of the plant. It would seem as if there ought to be a combination of these two modes of investigation, that is, that macro-chemical study of the plant should be accompanied by a micro-chemical study. One who has ascertained the presence and quantity of the more important constituents is prepared to trace these substances in its various tissues. The comparative study that is then possible needs no emphasis.

On page 179 of the July number of the BOTANICAL GAZETTE I gave a scheme of analysis in which macro- and micro-chemical work are combined. I shall not repeat it here, but an examination of that scheme will be necessary

*Read before the A. A. A. S., Buffalo meeting, 1886.

before, not only the laboratory arrangement I am about to describe, but the whole bearing of the paper can be really understood.

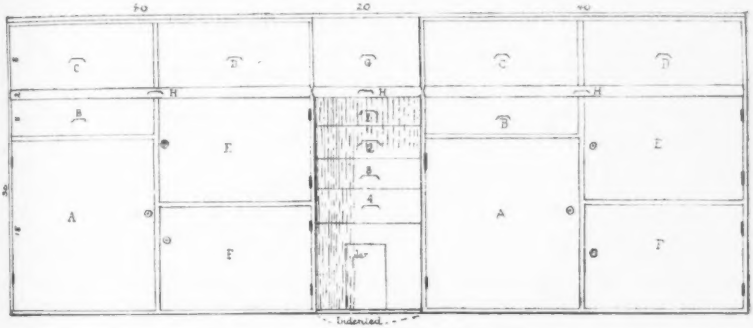
That scheme includes the more important plant products, and by studying any plant as indicated the student is acquainted with a good number of them. In spite of time required, the qualitive value of the quantitative work makes its omission impossible. It frequently tells where the individuality or active principle of the plant lies. Of course this is the real end of botanical proximate analysis.

The books needed in carrying out this analysis are easily obtained. Prof. Goodale and Bessey's botanies and Prof. Trelease's translation of Poulsen's Botanical Micro-Chemistry give directions for the micro-chemical work, and Dragendorff's Plant Analysis for the macro-chemical. Dragendorff's book is rather difficult for beginners, but can be supplemented by the investigations of some one who has followed his general plan. Miss Helen Abbott read a paper, entitled "A chemical study of Yucca Angustifolia," before the Association last year that seems to me particularly suited to this purpose. It is something more than an intelligent following of Dragendorff. It is a model as regards the use of the five senses and in its deductions from what is observed. This last alone would be sufficient reason for placing it before students.

The plant to be taken depends upon the end in view. If investigators in botany are to be trained a fresh plant will be chosen each time for the purpose of stimulating observation and generalization. If botanical information is to be given in a short period of time some plant whose anatomy is familiar will be selected, though it may be remarked in passing that it is believed, if form depends on composition, the time will come when anatomy study will accompany the macro- and micro-chemical study. Fortunately a valuable laboratory guide for anatomy study has just appeared. For botanical information the plant richest in products and showing its chemical characteristics most readily on the application of proper tests will, of course, answer best. If this plant was one, one or more of whose constituents were sold on the market, these could then be obtained in sufficient quanties to allow that fuller study that is not possible with the amounts obtained in the above analysis.

If the introductory remark that chemistry lies at the bottom of all botanical work is accepted, then a botanical laboratory will be a chemical laboratory with convenient arrangements for plant study. I have here a plan of a laboratory desk that I have arranged for the work. While a modified chemical laboratory desk it seems to me not unsuited to all work now generally done in botanical laboratories. The desk is 40 in. long, 36 in. high, and 31 in. deep. It has three drawers and three cupboards. Cupboard *A* is for the compound microscope, drawer *B* for the apparatus generally used with it, and *C* for mounting materials. *D* is for the simple microscope and other apparatus used in analyzing flowers, *E* is for holding bottles of material undergoing maceration, and *F* for fresh plants. *H'* can be drawn out and used for holding mounted specimens from the herbarium near by. *HH* are pieces that form a table for the compound or simple microscope when drawn out. The desks are set in groups of four, as a whole having the shape of a truncated triangle. Book-

shelves for ordinary working books are placed at one end of the group. The other ends are placed against the wall, between two windows, so that the drawn out tables will be in front of windows and receive plenty of light. Drawer *G*, between the two desks, is for the smaller pieces of chemical apparatus. Drawers 1, 2, 3, 4 are for students' use. They are set back, leaving a space in front for refuse solids, in the sides of which are nails for holding rags, apron, etc. Each desk has two gas jets, a faucet, the water falling into the sink below, and tin hood for assisting in ventilation. I have found these tin hoods of great use for



PLAN OF LABORATORY DESK.

this purpose. I think that with these, and a gas chamber for generating hydrogen-sulphide, chlorine and one or two other gases, the microscope would not be injured by being kept in the laboratory if shut up in close box when not in use.

It is intended that one desk will be furnished with the reagents ordinarily employed in inorganic chemistry. The next with those of organic chemistry. Of these petroleum spirit, ether and absolute alcohol will constitute the chief expense. Petroleum spirit and ether can be readily recovered by using the condenser, so that absolute alcohol might be said to be the only great expense. Even if recovered it could only be employed as a weaker alcohol.

The individual desks are to be furnished only with the simpler pieces of apparatus as measuring flasks, pieces of platinum, porcelain crucible, etc., etc The balance, polariscope, spectroscope, condenser, platinum dish, etc., will be used in common. It is thought that the additional expense of carrying on the work as laid down will be slight in those places where botanical laboratories are properly equipped for the study of plant anatomy.—LILLIE J. MARTIN.

Some additions to the Sylva of North America.—During the month of April of this year I was able, in company with Messrs. C. G. Faxon and A. H. Curtiss, to make a somewhat detailed examination of the trees of the semi-tropical Florida region, among which should now be included:

Myginda integrifolia Lam. (M? latifolia Chapman, Flora, not Swartz), a

peculiar plant, not rare in the West Indies, and, although early collected upon Key West in a shrubby state, often confounded in American collections with M. latifolia and M. pallens; referred to Ilex by Kunth, and on account of its dioecious flowers and suspended ovules made by Grisebach (*Cat. Plant.* Cub. p. 15) the type of his section *Gyminda* of the genus Myginda. Myginda integrifolia is truly arborescent upon Key West, reaching a height of 20 to 25 feet, with a straight slender trunk, not rarely six inches in diameter. It may be distinguished from the other North American species of the genus by its entire obovate leaves, rounded or often deeply emarginate at the apex, revolute, pale yellow-green in color; its wide-spreading axillary and terminal cymes, dioecious flowers, the staminate with long erect filaments (those of M. pallens become reflexed between the petals upon the expansion of the flowers) surrounding a deeply-cleft pistillate process, the pistillate flower with two-lobed sessile stigmas with a single suspended anatropous ovule in each cell, and by its small dark blue or black ovoid drupe, the large embryo surrounded with a thin covering of albumen.

Terminalis Buceras Bentham & Hooker (Bucida Buceras L.). This well-known West Indian tree was first seen in the U. S. by Mr. Curtiss. It is common in the hummocks, near a Mr. Farley's house, towards the east end of Elliott's Key, where we found it in full bloom on the 19th of April. It is here a fine tree, sometimes 50 feet in height, with a trunk 12 to 18 inches in diameter, these tall, upright stems often springing from stout, short, prostrate trunks two to three feet in diameter. The wood is heavy, hard and moderately close-grained, but probably of little value except for fuel.

Pseudophœnix Sargentii H. Wendland (in lit.) Dr. Wendland proposes provisionally to establish a new genus in Chamedoriæ, to receive an arborescent Palm, also detected by us near the eastern end of Elliott's Key, with abruptly pinnate leaves four to five feet long, the pinnæ lanceolate acuminate 12 to 16 inches long, bright green above, glaucous beneath; branching interfoliaceus spadix 36 inches long by 30 inches wide, the main and secondary branches very light yellow-green, flattened and the latter thickened at the base, especially on the upper side, with an ear-shaped process, and with three-lobed three-seeded fruit or often one or two-lobed by abortion, one- half to three-fourths of an inch in diameter, in April bright orange or red, fleshy and very conspicuous. Unfortunately neither flowers nor mature fruit could be found, so that Dr. Wendland, to whom specimens were submitted, is unable to characterize the interesting addition to the North American sylva.

The Pseudophœnix is a tree with the general habit and appearance of Oreodoxa, 20 to 25 feet in height, with a trunk 10 to 12 inches in diameter. Six individuals only, in two localities, two or three miles apart, were found.

It is perhaps worthy of remark that upon the island of Key West, which is less than four miles long by about three-quarters of a mile wide, there are growing at the sea level 41 indigenous arborescent species, a greater number no doubt than can be found in any other area of similar extent in the United States. Lysiloma latisiliqua, Colubrina reclinata, now the rarest of the Florida trees, and Clusia flava, not rediscovered in Florida during the last 40 years, and

probably not now growing naturally in the United States, although found on Key West, according to Nuttall, in Dr. Blodgett's time, have now disappeared from the island; and it is not improbable that other species, which now flourish upon the adjacent islands, have been exterminated from Key West in the general cutting of the woods which is continually going on there.—C. S. SARGENT.

EDITORIAL.

IN REFERRING to the botanical papers at the recent Buffalo meeting of the American Association the *American Naturalist* takes occasion to remark that "it is noticeable that they include no physiological subjects, and that the tendency is strongly toward the systematic side of botany, which may be taken as indicating the prominent position which this phase of botanical science still maintains with the leaders." In regard to this conclusion we beg to differ, as not necessarily following from the fact stated, and as being contradicted by our own information. The GAZETTE has a wide acquaintance among our most active young botanists, and has had frequent consultations with them as to the most promising field for an energetic young worker to cultivate. A few years, often too few, perhaps, are spent in special and costly preparation of a general kind, and then every spirited student desires to enter some special line of work, in which he proposes to become an authority. The easiest advice to give is that he should follow the bent of his desires, but the average young botanist is compelled rather to follow the bent of his opportunities. Physiological botany is a great department, an exceedingly important and attractive one, and should be cultivated by all who can do so, and we know more than one keen American botanist who would willingly exchange all his chances in systematic work for a good opportunity to follow out his physiological bent. But the appliances for good physiological work are costly and entirely beyond the reach of the average American botanist. Of course any amount of physiological work can be conducted in ordinary laboratories, but such work is purely elementary and only serves for class illustration. What our young botanist wants is to become an authority in some department of physiological botany, and how is he to do it with the means at his command? Systematic botany, on the other hand, requires no such unattainable appliances, and what information is needed from unattainable books or specimens can be had by correspondence or an occasional visit to some herbarium where they are to be found. All that is necessary is the selection of some group that needs work (and there are plenty such), the accumulation of all books and specimens possible, and then a settling down to study. As being a thing that can be done, it naturally becomes the thing that is done. We must guard against a too hasty conclusion from these remarks that in our opinion most of our young systematists would be physiologists if they could. There are some among them who would be systematists from choice were the whole field of physiology open to them. We simply make the claim that our young botanists are fully alive to all the interests of their science, physiological as well as systematic, and were equal opportunities offered would be fairly distributed among the different departments.

BOTANICAL ACTIVITY is manifesting itself by contributions and bulletins from the laboratories and science departments of our various institutions of learning and research. In comparing these one finds that they are of very uneven value as permanent additions to the world's knowledge. They all show ability to deal with new problems, but the worker often leaves the reader to find out for himself just where he stands, and what relation this contribution holds to what other workers have already recorded. We venture to say that the difference in the value of results is mainly referable to the equipment in libraries, specimens and indexes, possessed by the several institutions. Many workers, possibly the majority, are inadequately supplied with these requisites for determining and recording the relation which their results bear to the present record of facts, or for directing their attention to the most profitable part of the field of research. Of these helps, the last is especially important, for unless all available literature and material is fully indexed, by means of a card catalogue or some similar system, it is hopeless to expect the student to thoroughly compass his subject, and to exert his powers to the best purpose.

OPEN LETTERS.

Letter from Commissioner Colman.

To the Members of the Botanical Club of the American Association for the Advancement of Science:

LADIES AND GENTLEMEN:—I have noted with extreme gratification the interest you have taken in the work established by me in this Department, relative to the investigation of the fungus diseases of plants; and the resolutions you have passed commending my action and assuring me of your support and aid in securing the necessary means for the continued and successful prosecution of this most important undertaking, are fully appreciated, and I wish to thank you on behalf of the farmers and fruit growers of the country, in whose interest and for whose direct benefit this work is designed.

As you are well aware, only a few of the more important plant diseases have been thoroughly worked out by scientists, and the little that has been done—little when compared with what there is to do, but a great deal when considered by itself—has been the result of private effort on the part of some of your own well known members. Such obscure diseases as the peach-yellows, the cotton rust and the "foot rot" of the orange tree, demand immediate attention, and, for their proper elucidation, we need to command the services of our most skillful investigators, giving them opportunities to make special studies in the field until the knowledge desired is gained. As you have well suggested a liberal supply of funds is required for this work.

In addition to the assistance in this particular, to which you have so generously pledged yourselves, I beg leave to call your attention to the fact that you, as botanists, knowing our cultivated and native plants and the fungus parasites infesting them, may do much valuable service as *observers*, in your respective localities, by recording such facts as may come to your notice relating to this subject and by collecting and transmitting to the Department material useful in the investigations, or that may serve to record the distribution of the injurious species of fungi.

Facilities for this work and a free use of the mails will be accorded those who may have such notes or materials to transmit, and the source of all matter that may be used for publication will be properly credited.

Again thanking you for your hearty commendations of my course in relation to this subject, and assuring you that I shall continue to do all in my power to further the work, I remain Yours respectfully,

NORMAN J. COLMAN, *Commissioner.*

Department of Agriculture, Washington, D. C., Oct. 20, 1886.

Second blooming of Salix humilis.

On the 25th of last September, while collecting the leaves of some willows, I came across a bush of S. humilis which was full of partially developed staminate catkins and three fully developed ones. I visited the place two weeks later and about one-half of the catkins had bloomed. The other half had dried up and withered.

OLIVER A. FARWELL.

Phœnix, Mich.

CURRENT LITERATURE.

Plant Analysis: qualitative and quantitative. By G. Dragendorff, Ph. D. Translated from the German by Henry G. Greenish, F. I. C. J. H. Vail & Co., New York, 1884. 8vo. pp. 280.

The study of plant constituents, a most important part of a full knowledge of plants, received a great impetus from the publication of this work. Both in its original form and its English version it at once attracted attention for its completeness, compactness and adaptability to the requirements of the student. The translation is exceptionably accurate and satisfactory, and has all the value of an original work.

The study of chemical botany is now receiving more attention than heretofore, and merits, and is likely to obtain, a larger place yet in the curriculum of botanical science, being especially appropriate as a part of the course in vegetable physiology, and even more so in medical and pharmaceutical botany. This change can be chiefly traced to the influence of Dr. Dragendorff's work, for although it has been before the public but a short time, it has nevertheless come to be looked upon as the standard and necessary guide in such study.

A certain amount of knowledge of chemistry, chemical manipulation, and of the microscope, is presupposed in the pupil, but having this, the work will be found as clear and simple as the complex nature of the subject permits. Its arrangement is such that it can not fail to stimulate the pupil to original investigation, for while the limits of the work would only permit the introduction of the more important constituents of plants, yet he is kept upon the alert for less usual or unknown compounds, which are to be worked out from information gathered elsewhere, the copious references to literature aiding him in his research.

The fact that the work is specially adapted for the investigation of chemical problems from a botanical point of view, makes the notice of it at this time peculiarly fitting, as Miss Martin's recent articles on the subject have undoubtedly turned the thoughts of our readers in this direction.

General Biology. By William T. Sedgwick, Ph. D., and Edmund B. Wilson, Ph. D. Part I. 8° pp. vii. 193. Henry Holt & Co., New York, 1886. American Science Series.

A new book on biology is always welcome, especially when it deals with methods of laboratory work. Every respectable teacher believes in laboratory methods, but every good teacher follows no guide blindly, and has notions of his own as to the order and details of presentation. The very fact that a constant succession of laboratory guides is appearing shows that teachers differ as

to these matters of detail, and the wise teacher will use his own methods and cull out from all these laboratory guides the things that are adapted to his wants. We believe in general biology, and think it should be more generally taught, and the book before us serves well as an introduction to the more detailed study of either plants or animals. The method proposed is to state the general principles of biology, illustrate them so far as possible by laboratory work, and then make a detailed study of a single plant and animal. For this reason a fern (Pteris aquilina) and an earth-worm are selected. Four chapters are devoted to the preliminary statement and illustration of principles, six to the study of the two types mentioned, and one to a discussion of classification. It is very true that an ordinary laboratory guide often leads to the accumulation of an undigested mass of facts, and the student has in the end no clear conception of the relations of things, but this simply results from the wrong use of such a guide. It is not expected in these days that a student is to get all his knowledge of a subject from a single book, and he who uses a laboratory guide, either in the absence of a living teacher or without some good general text-book, can not expect to obtain the best results. Our only criticism of this book is that while it dispenses with the necessity of both text-book and teacher in the general statement of biological principles, it creates a greater necessity for both in following the laboratory directions than any guide we have yet seen. The book is to be an introductory one, so introductory that the student is to be taught the use of the microscope, but the laboratory directions are so condensed, many of the operations are so difficult, and, more than all, the material is so varied that it would tax our best equipped laboratories and our best trained teachers to have a beginning class follow them. To save a constant supervision on the part of the teacher, and the almost impossible attempt to get together such varied material, we prefer explicit directions in laboratory work, a few types, and to leave to the teacher the task of enunciating principles. It must not be understood for a moment that we disapprove of the laboratory directions, for they are excellent, very desirable to follow, and well illustrate the principles of biology. The criticism only raises the question as to their adaptability to introductory work and the average American laboratory. The figures of the book are numerous, well executed, and refreshingly new, and it would be well if they could be an incentive to more numerous and better drawings in our laboratories. We commend this book to the careful attention of teachers, and feel confident that it is one that they can not afford to be without.

British Fungi (*Hymenomycetes*). By the Rev. John Stevenson. Vol. II, Cortinarius-Dacrymyces. Edinburgh: Wm. Blackwood & Sons, 1886. pp. 336. Large 12mo. Illustrated.

The second and concluding volume of this work, completing the order Hymenomycetes, follows the first with remarkable and commendable promptness. That they should both be issued within one year was unexpected, but will give great satisfaction to collectors.

The first volume was noticed and commended in the July number of this journal (where a typographical error made the date read 1866 instead of 1886), and only a few words need be added here. The second volume contains over fifty genera, of which the largest, with the number of species of each, are as follows: Marasmius 36, Boletus 41, Russula 42, Clavaria, Hydnum and Lactarius 46 each, Cœticium 48, Hygrophorus 54, Polyporus 124, and Cortinarius 130. The descriptions are equally complete and satisfactory with those of the first part. A convenient glossary is added, which also illustrates the care that has been exercised in excluding dispensable terms, and in simplifying the technical nomenclature as much as possible. Each volume possesses its own index.

Both the author and publishers are to be congratulated upon the satisfactory completion of so valuable a handbook. While being an aid to the American student, the need of such a work for our own country will yet make itself the more keenly felt.

NOTES AND NEWS.

SOME SEVENTY SPECIES of lichens from Florida collected by W. W. Calkins, and mostly determined by H. Willey, are enumerated in the *Journal of Mycology* for October.

DR. BYRON D. HALSTED will spend the winter months in the neighborhood of Los Angeles, California. He will remain there from the middle of November to the middle of February.

A CRITICAL STUDY and revision of the Hysterineæ in the Duby Herbarium, by Dr. Rehm, is begun in the fourth heft of *Hedwigia*, and will prove of interest to systematic mycologists.

IN THE *Bulletin of the Torrey Botanical Club* for October, Dr. N. L. Britton distinguishes two forms of what has been called Anychia dichotoma, and restores Decandolle's A. capillacea to specific rank.

A HANDBOOK of the cryptogamia is being prepared by Alfred W. Bennett (6 Park Village East, London, N. W., England), who desires that authors will send him copies of their recent articles pertaining to this subject.

CARL OSCAR HAMNSTRÖM died at Hessleholm, Sweden, on July 5 of this year, at the age of 70. We learn from the *Botaniska Notiser* that his chief botanical works comprise studies of parts of the Swedish flora, published between 1842 and 1851.

IN THE OCTOBER *Journal of Botany* Baron F. von Mueller describes a new genus of Vacciniaceæ from New Guinea, naming it Catanthera. Its salient characters are petals perfectly separated and anthers continuously completely bent downward.

AN ERINEUM on the flowers of cultivated grapes is recorded by J. E. Planchon in the last *Revue Mycologique*, as being found in two localities in France. Erineum usually appears on the upper surface of leaves, and has probably never before been found on the flowers.

IN *Nature*, for September 30, is printed a charming lecture by H. Marshall Ward, on the subject of roots. In popular language he gives an idea of the activities of the root, and shows what complex conditions are at work, influencing the life of the whole plant. Special attention is paid to the oxygen supply.

NOTES ON TOMATOES, by Prof. L. H. Bailey, Jr., occupy Michigan Agricultural College Bulletin No. 19. Seventy-six seedsman's varieties were grown the past year, and a critical synopsis prepared in which the number of names is reduced nearly one half. Remarks upon their earliness, productiveness, amount of rot, and germination are given.

THE COMMON YARROW (Achillea Millefolium) is observed by Rev. G. Henslow, before the Royal Horticultural Society of England, to be gyno-diœcious. The female florets have abortive anthers without pollen. They also differ from the hermaphrodite florets by sometimes having fewer petals and stamens, slightly longer ovaries, and the corresponding tubes slightly shorter.

THE ANATOMY and development of Agarum Turneri, the sea colander, by Mr. J. F. Humphrey, forms the fifth contribution from the cryptogamic laboratory of Harvard University. The frond was the part studied. It agrees closely in structure with that of other Laminariaceæ. The interest centers in the manner of forming the perforations, which is well described and illustrated.

MR. G. H. PARKER furnishes the sixth contribution from the cryptogamic laboratory of Harvard University, on the morphology of Ravenelia glandulæformis. Our knowledge of this odd member of the Uredineæ has been very incomplete. The paper shows that each head of teleutospores, from its earliest development, is a group of adnate pedicelled spores. The other species and the literature of the genus are reviewed.

A SKETCH of the life of C. C. Frost of Vermont, who died in 1880, is given in the October *Journal of Mycology*. It is from the pen of Prof. Wm. R. Dudley, after a visit to Mr. Frost's late residence, and is an interesting account of a modest and retiring botanist. Mr. Frost's chief work, done conjointly with Prof. Tuckermann, was a Catalogue of Plants of Amherst, in which he described sixty species of fungi, mostly of the fleshy sorts.

PROF. CHARLES R. BARNES has published, as one of the bulletins of Purdue University, an analytic key to the genera of mosses, recognized in Lesquereux and James's manual of the mosses of North America. As is well known to those attempting to use the manual referred to the analytical key to genera is anything but satisfactory. Professor Barnes has attempted to supply this need and to lessen the difficulties in the way of students of mosses. Copies can be had on application to Purdue University.

THE VERY INTERESTING presidential address of Professor Carruthers, before the biological section of the British Association, on the age of some existing species of plants, is published in full in the *Journal of Botany* for October. Comparing the species of mummy plants and those of recent geological deposits with their living representatives the conclusion reached is that the data given must be considered "as confirming the long-established axiom that by us, at least, as workers, species must be dealt with as fixed quantities."

IN COLLECTING marine algæ for microscopic study, members of the Quekett Microscopical Club have found it convenient and satisfactory to carry a bottle of good glycerine, and as the material is gathered wash well in sea water and drop it into the bottle. Enough specimens must not be put into a bottle to thin the glycerine too much with sea water. Such material can afterward be mounted in glycerine jelly. Some kinds, like Polysiphonia and its allies, are not well preserved in this manner, and for such a saturated salt solution should be used.

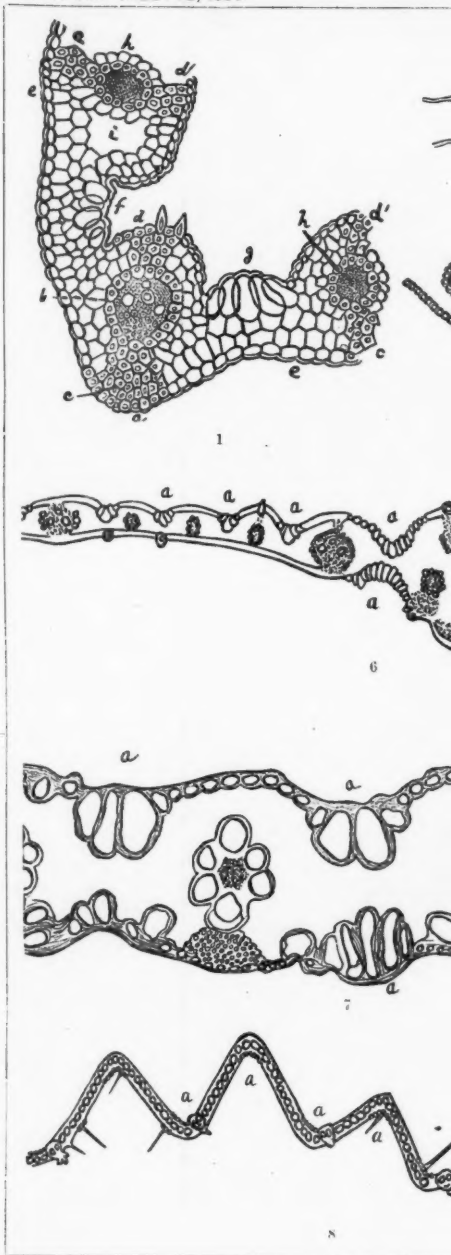
MR. JAMES BRITTEN is doing some good work in the matter of raising questions concerning the priority of certain generic names. He has given in the last *Journal of Botany* a paper on the nomenclature of some Proteaceæ, in which the rights of Salisbury are put forward and rather severe strictures passed upon some distinguished botanists. As to the merits of the case we have nothing to say, but if priority is to be a law at all, and if its sole object is to be fixity of names, the sooner all questions of priority are settled the better: and they must be settled in spite of sentiment, or fitness, or universality, for short of absolute priority there is no fixity.

THE BOTANICAL PAPERS read before the Birmingham meeting of the British Association are as follows: Initiation of a discussion upon the value of the "type-system" in the teaching of botany, Prof. Bayley Balfour; On the germination of the spores of Phytophthora infestans, Prof. Marshall Ward; On the flora of Ceylon, especially as affected by climate, Henry Trimen; On Humboldtia laurifolia as a myrmecophilous plant, Prof. Bower; Note on the floral symmetry of the genus Cypripedium, Dr. Maxwell T. Masters; Bugio, the biological relations of an Atlantic rock, Michael C. Grabham; The multiplication and vitality of certain micro organisms, Percy F. Frankland.

SOME INTERESTING FUNGI from phosphate caverns of Quercy, France, 500 feet below the surface, collected by M. Marty, are described by M. Roumeguère in the last *Revue Mycologique*. These include two species of Agaricus, one of Coprinus, two of Stereum, two of Telephora, and a diminutive Genea. The most interesting one is the Coprinus, C. subterraneus, n. sp., which hung pendent from the ceiling of the cave by thousands. The filiform stipes, a foot or more long, much twisted and often branched, were inflated to an inch in diameter at the base while the other end was recurved, and supported the grayish brown pileus in an upright position. When lighted by the lamps of the explorers the roof scintillated with the reflections from the moist pilei.

THE STRUCTURE of the diatom valve is the chief subject considered in the last number of the *Journal of the Quekett Micr. Society*. The paper by Mr. Deby is of special interest as the author has based his conclusions upon a study of untreated valves from living diatoms, supplemented by those treated with reagents, and by fossil forms. He finds that the valve may (for convenience of elucidation) be said to consist of three layers, an outer continuous one, which is thin, rarely silicified, and readily dissolved by acids, a thicker inner one, also continuous, but silicified, and an intermediate wall of silica completely perforated, giving the valve its appearance of areolation. This view, as elaborated by the author, seems more in accord with our knowledge of the structure of other vegetable cells than those of the well known diatomists, Müller, Van Ermengem, Flogel, Cox and Van Heurck.

A. ERNST, of Caracas, in *Nature* of October 7, gives an account of what he considers to be a new case of parthenogenesis in the vegetable kingdom. It is a menispermaceous plant, described by Eichler as *Disciphania Ernstii*, a very rare genus, containing but one other species. Strictly dioecious, Ernst has cultivated it carefully and found that his female plants "produced in three successive years an increasing number of fertile fruits without the operation of any fertilizing pollen from a male flower." He also attempted to discover whether, as in the case of Cœlebogyne, the embryo is developed as an outgrowth from a cell of the nucellus, but discarded the idea on the ground that that process is connected with polyembryony, and there is no such thing in Disciphania, a conclusion which, by the way, may be somewhat hasty. Hence the claim is that this furnishes a case of the development of an unfertilized oosphere. Of course the strength of food-supply is considered in this connection, and altogether it is a matter well worth looking into.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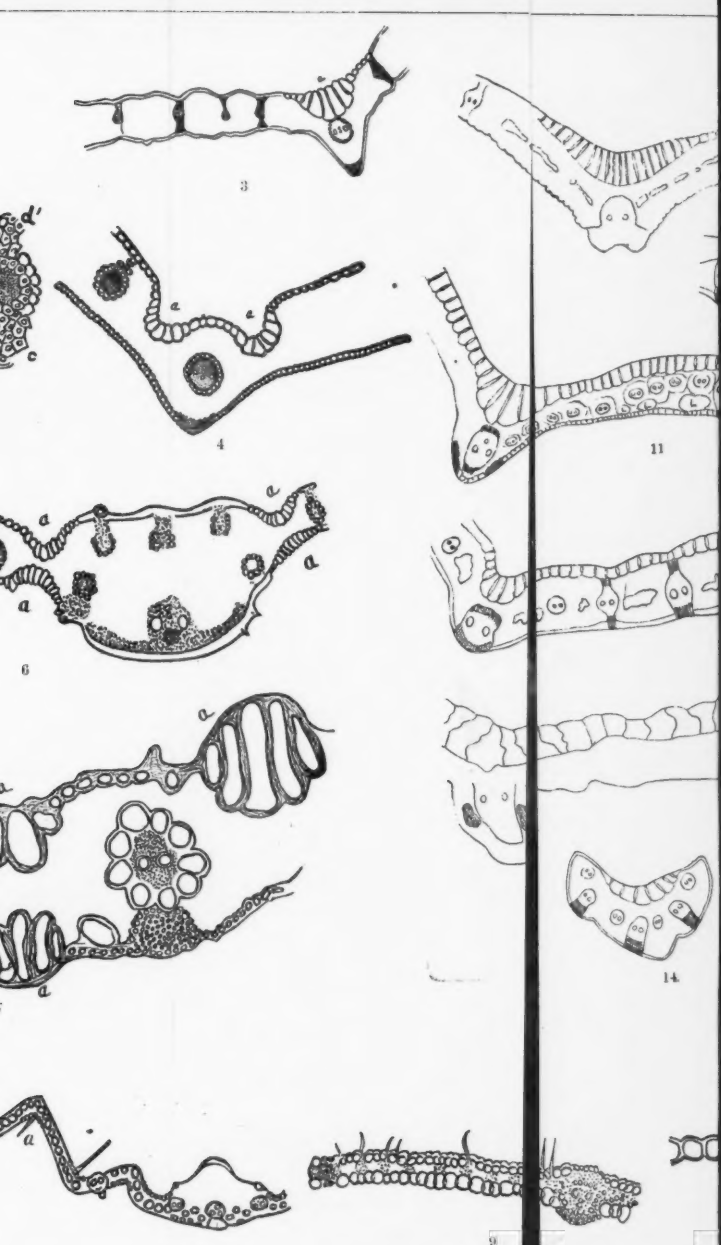
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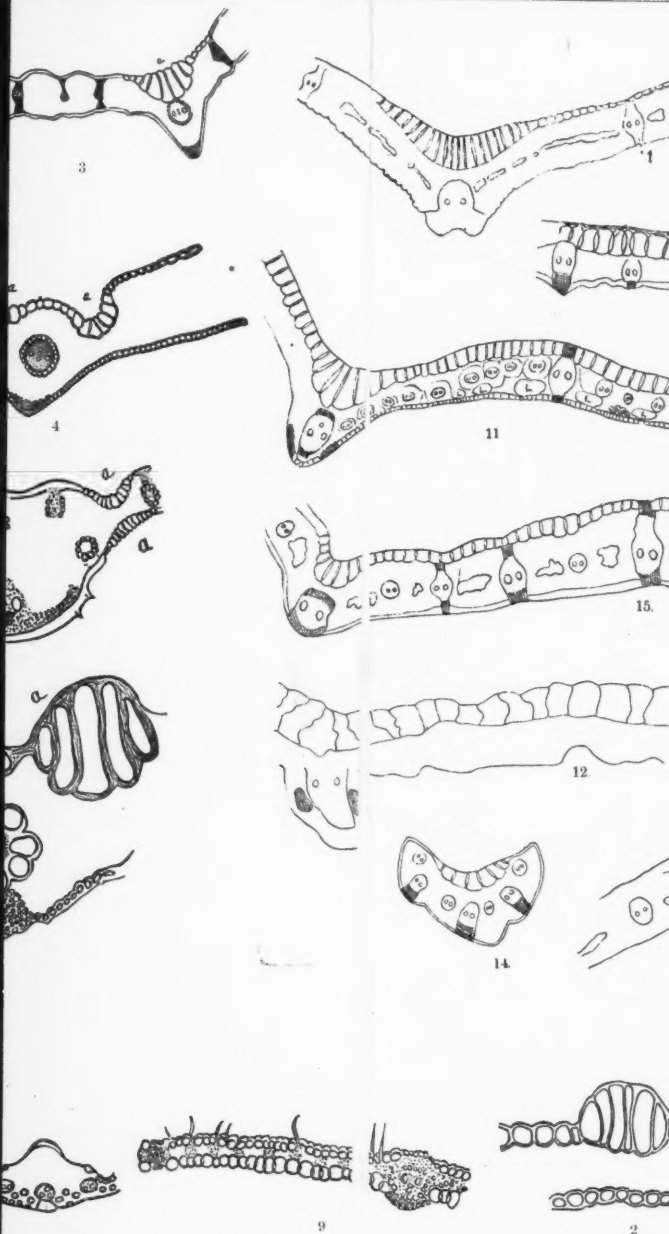

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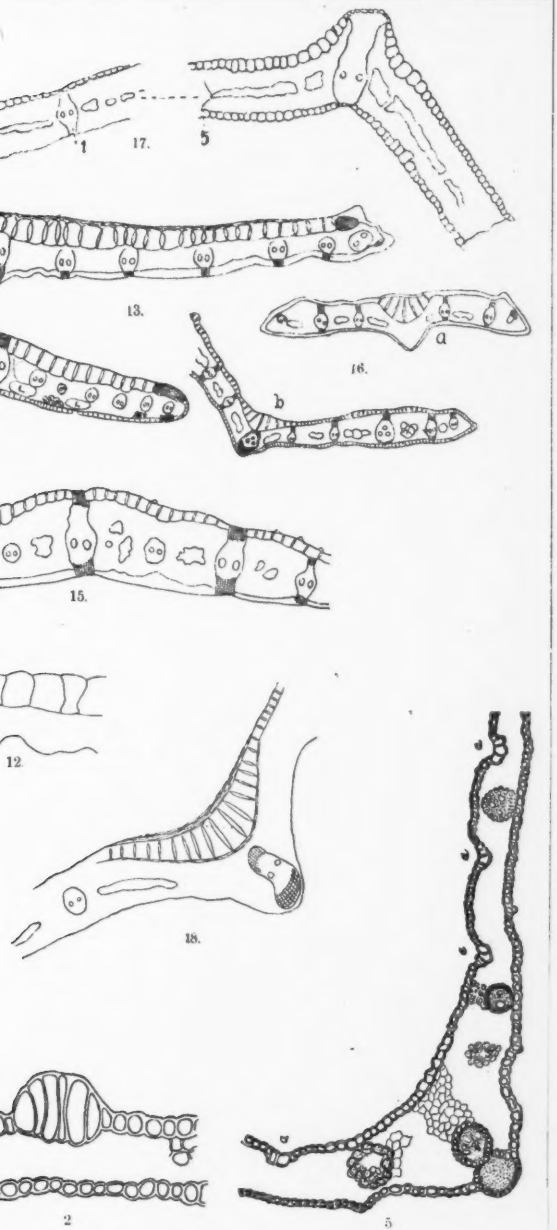
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